



# The River Mile

## Water Quality

### Lesson # 7

## Water Quality: Point Source and Non-Point Source Pollution



Developed by the Lake Roosevelt Forum to support "The River Mile" National Park Service Program

<p><b>Suggested duration:</b> 90 minutes</p>	<p>LESSON # 7</p> <p><b>Water Quality: Point &amp; Non-Point Source Pollution</b></p> 
<p><b>Inquiry Question:</b> How do metals and chemicals such as mercury, zinc, dioxins, furans and PCBs get into the water?</p> <p><b>Inquiry Process:</b> Variables: controlled, dependent &amp; independent</p> <p><b>Standards:</b> PS2, PS3, ES2, LS2</p> <p><b>Assessment:</b> Mapping PS pollution</p> <p><b>Materials:</b> Watershed model trays, soil, rocks, small plants, Watering bottle Sprinkler top Food coloring Pink &amp; green sprinkles Chocolate sprinkles Oregano or parsley Vinegar Baking soda Ph paper</p> <p><b>Handouts:</b> Stream Table Model Toxic Dump lab Points, Plots &amp; Transects</p> <p><b>Credits/Citations:</b> <b>FOSS Earth Forms Kit</b> Exploratorium You Tube Videos <a href="http://www.scorecard.org">www.scorecard.org</a></p>	<p><b>INTRODUCTION:</b></p> <p><b>Point Source:</b> Near the Canadian border, the upper Columbia River is still flowing before it becomes the reservoir Lake Roosevelt. In the Northport area there are striking black sand beaches caused by slag (from mining operations in Canada. Currently EPA is investigating human health &amp; ecological damage caused by this point source. Other examples of point source pollution are pulp mills, aluminum plants, waste water treatment plants that discharge into rivers. In point source contamination the contaminant origin is known.</p> <p><b>Non-point sources</b> are non-specific and often associated with storm water and agricultural runoff. Contaminants from a variety of sources, such as streets and farms, are picked up by storm water, and enter groundwater or travel directly into lakes and rivers untreated. Hydroelectric facilities are grouped into the category of non-point source pollution. Other examples of non-point source pollution are erosion and removal of shading vegetation next to waterways.</p> <p><b>STUDENT WORK AND ASSESSMENT:</b> Mapping Skills</p> <p><b>QUESTIONS TO EXPLORE/INSTRUCTIONS/PROCEDURE</b></p> <ol style="list-style-type: none"> <li>1. Students view &amp; discuss one or more of the You Tube videos, on Point source &amp; Non-Point Source pollution</li> <li>2. Introduce the concept of Point &amp; Non Point source Pollution. Make a class list of possible sources for the Columbia River &amp; Lake Roosevelt including possible sources in the local community.</li> <li>3. Research the EPA listed point source polluter by zip code at <a href="http://www.scorecard.org">www.scorecard.org</a> . Map the PS in your community</li> <li>4. Observe, draw and test watershed models to demonstrate PS &amp; NPS pollution movement due to storm events       <ol style="list-style-type: none"> <li>a. <i>Storm water: Don't dump that here!</i></li> <li>b. <i>Toxic Dump: Where is it coming from?</i></li> </ol> </li> <li>5. <b>Optional:</b> Students write to a Classroom EPA team requesting a study of their (stream table) Watershed. Identify concerns and the evidence collected to determine the sources of pollution.</li> <li>6. Each team becomes the EPA team for another group's watershed and investigates the complaint. EPA teams propose best management practices, clean up efforts and new laws to reduce or eliminate the impact of PS &amp; NPS pollution?</li> </ol>

## WATER QUALITY: POINT SOURCE AND NON-POINT SOURCE POLLUTION

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### **Essential Question:**

- What are the sources of water pollutants?

### **Inquiry Question:**

How are pollutants transported into and throughout the Lake Roosevelt watershed?

### **Objectives:**

You will:

- Use internet resources to research local point source polluters
- Explore non-point sources of water pollution using a watershed model
- Develop a map using points, plots and transects

### **Introduction:**

**Point Source (PS)** pollution is the origin of known or deliberate environmental releases (e.g., land, air & water pollution) from fixed points such as a metal refinery, mine, power plant, pulp mill, smokestack, wastewater discharge pipes, and others.

**Nonpoint Source (NPS) pollution**, <http://www.epa.gov/owow/NPS/qa.html> unlike PS pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even in our underground sources of drinking water. These pollutants include:

- ⇒ Excess fertilizers, herbicides, and insecticides from agricultural and residential lands;
- ⇒ Oil, grease, and toxic chemicals from urban runoff and energy production;
- ⇒ Sediment from construction sites, crop and forest lands, and eroding streambanks;
- ⇒ Salt from irrigation practices and acid drainage from abandoned mines;
- ⇒ Bacteria and nutrients from livestock, pet wastes, and faulty septic systems;
- ⇒ Atmospheric deposition and hydro-modification are also sources of NPS pollution

### **Think Time:**

My thoughts, ideas, and questions about pollution in my community:

## “You Tube” Videos: POINT SOURCE AND NON-POINT SOURCE POLLUTION

1. View, Listen and Evaluate: Select one or more of these videos
  - a. Non-Point Source Pollution: An introduction to Storm water <http://www.youtube.com/watch?v=cACFw8lzkPI&NR=1>
  - b. Water Pollution Final <http://www.youtube.com/watch?v=a-x0AJQ5zHQ&NR=1>
  - c. Stop Non-Point Source Pollution! <http://www.youtube.com/watch?v=XdtQhTV0J6g>
  - d. TOXIC SPILL TRAIL BC CANADA <http://www.youtube.com/watch?v=2zMT6Bt14NA>
  - e. Frogline - Nonpoint Source Pollution Education <http://www.youtube.com/watch?v=HhIPtNX5XTM>
  
2. Record 3-5 factual details and your thoughts or ideas about the presentations.

<b>Notes from the point source and non-point source pollution videos.</b>	
<b>Make a list of local pollution sources.</b>	
<b>POINT SOURCE (PS)</b>	<b>NON-POINT SOURCES (NPS)</b>

3. Compare your lists with two other students

## Environmental Defense Scorecard – The Pollution Information Site – [www.scorecard.org](http://www.scorecard.org)

Explore this website and find out about....

**Point Sources** – Where are the known sources of pollution in your community? What types of pollutants are being released?

**Non-Point Sources** – How might pollution from neighboring counties be impacting your community?

1. Go to [www.scorecard.org/](http://www.scorecard.org/) Data were verified by the Environmental Protection Agency.
2. Look at the home page. In the left hand column you will see pollution topics to investigate: Toxics, Air, Water, Agriculture, Environmental Justice and Health Hazards.
3. At the bottom, enter your home or school zip code into the “ZIP to Your Community” box and click on “GO”
4. Review the Pollution Report Card for your zip code which will give you information about your entire county.
5. Click on any word you don’t understand and you will be taken to a definition
6. As you review the report card, enter the data on the forms provided
  - a. Find out Toxic Chemicals Released by Factories, Power Plants and Other Industrial Companies
    - i. How does your county rank in the % dirtiest or cleanest in the country?
    - ii. Locate the PS names rank, city and the # of pounds of pollution they produce
    - iii. Find the names of the major pollutants, their rank and the # of pounds produced
    - iv. What percent of homes in your county are affected by lead hazards?
    - v. Are there any Superfund sites in your county?
  - b. Study the information about Air quality and record the data in the table provided:
    - i. How does your county rank in the % “cleanest or dirtiest air” in the country
    - ii. Are there facilities in your county releasing air pollutants? What kind and how much?
  - c. Finally, study the information available about water in your county
    - i. How does your county rank in the % “cleanest or dirtiest water” in the country?
    - ii. What percent of the water bodies are impaired?
    - iii. How many water sheds are located in your county? List the names
    - iv. Find the Surface Water data. What % of the Rivers, Streams, & Creeks are affected by Pollutants?
      1. Locate the % for: Pathogens, Temperature, pH, DO/Organic Enrichment, and Metals
    - v. Find the data for Lakes, Reservoirs, and Ponds and record the % affected by each of the following:
      1. Impaired Biological Community, Other, Temperature, Pathogens, Low DO/Organic Enrichment
  - d. Is your county impacted by animal waste (NPS)? What is the impact and why is it important?

Data on Scorecard was accurate between 1999 and 2005. What changes have happened in your county since then?

County	% Rank in USA	Toxic Chemicals Released by Factories, Power Plants and Other Industrial Companies				What are the Major Pollutants?			Lead Hazards	Superfund Sites
Zip code	among ___% of the dirtiest counties	Rank	Facility	City	Pounds	Rank	Chemical Name	Pounds	___ % of homes have a high lead risk	_____% of all counties in USA (#) _____SFS Name & wastes
Name										

County	Clean Air % Rank in USA	How Clean is Your Air? Air Quality (AQ)	Smog and Soot: How Much Air Pollution is Released in Your Community by PS?			Air Pollutant Standards Index	
Zip code	among the dirtier ___% of all counties in the U.S. in terms of pm-10 24-hr. ave concentration		Rank	Facility	Tons	0 - 50	Good
Name						50 - 100	Moderate
						100 - 200	Unhealthful
						200 - 300	Very Unhealthful
						300 - 500	Hazardous

County	Clean Water % Rank in USA	impaired water bodies %	Watersheds located in the County	Surface Water - % Rivers, Streams, & Creeks affected by Pollutants	Lakes, Reservoirs, and Ponds % affected by
Zip code	___% cleanest Surface water	___% impaired	____County contains a portion of (#)____ watersheds: (Write the names of watersheds)	Pathogens	___%
Name				Temperature	___%
				pH	___%
				DO/Organic Enrichment	___%
				Metals	___%
					Impaired Biological Community ___%
					Other ___%
					Temperature ___%
					Pathogens ___%
					Low DO/Organic Enrichment ___%

## Stream Table Investigation: Storm Water and Non-Point Source Pollution

**Materials:**

- |  |   |
|--|---|
| 1. Stream Table prepared w/NPSP            | 5. Meter stick and 50 - 100 ml cylinder |
| 2. Watering can/bottle with sprinkler      | 6. 5 - Ph test papers                   |
| 3. Catch basin                             | 7. 2 liters tap water                   |
| 4. Protective covering for table and floor |   |

**Observational Data Collection using Points, Plots and Transects:**

<ol style="list-style-type: none"> <li>1. Use the meter stick to mark one (1) cm points on all four sides of the stream table pan</li> <li>2. The points will be used to visualize a set of grid lines across the stream table.</li> <li>3. Use graph paper and the stream table grid line points to draw a sketch of the stream table prior to the "STORM EVENT" include:             <ul style="list-style-type: none"> <li><input type="checkbox"/> Land forms, river beds, empty pan</li> <li><input type="checkbox"/> Non-Point Source pollutants on the land surface:                 <ol style="list-style-type: none"> <li>i. Animal waste – chocolate sprinkles</li> <li>ii. Pesticides – pink sprinkles</li> <li>iii. Nitrogen rich fertilizer – green sprinkles</li> <li>iv. Grass clippings, leaves, and yard organic wastes – dried oregano or parsley</li> <li>v. Oil &amp; grease from autos and machinery on roads or improperly dumped – vegetable oil mixed with soy sauce</li> </ol> </li> </ul> </li> </ol>	<p><u>Notes &amp; observations here:</u></p>          
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**Observe, test and record below the water prior to the "STORM EVENT"**

WQ	Stream Table Water Prior to Storm Event	Stream Table Water Post Storm Event
Ph		
Turbidity		
Particulate Matter		
Color, Smell & Appearance		

Storm Event Directions:

1. Fill the watering can or bottle with the water sample you tested and observed.
2. Place the sprinkling cap firmly on the watering can.
3. Hold the water source 50 cm above the stream table
4. Move the “rain” source evenly across the land surface from top to bottom and side to side until the watering bottle is empty.
5. Make observations during and following the Storm Event.
6. Observe, test and record the water quality after the storm event

<p>Draw a 2<sup>nd</sup> sketch of the same stream table after the “STORM EVENT”</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> If items on the first sketch have moved, draw the new location</li> <li><input type="checkbox"/> Notice if erosion has moved soil into the empty section of the stream table pan and draw the new landforms.</li> </ul> <p>If anything is visible now that was not visible before the “STORM EVENT”</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Draw the shape, color or make a margin note with an arrow pointing to the location where there may be a new smell.</li> <li><input type="checkbox"/> Analyze the stream table for evidence of the source of the “mystery toxic”</li> <li><input type="checkbox"/> Draw a line (transect) from the end point back to the possible point of origin. How did this mystery toxic travel?</li> </ul>	<p style="text-align: center;"><u>sketch here</u></p>
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7. Analyze the data for changes in water quality.
  - a. Did the water ph change after the storm event?
  - b. If so, what evidence can you find to explain the change?
8. Compare and contrast the before and after storm observations and write a short summary of the impact of storm water on water quality and transporting NPS pollution.

**Conclusion:**

States report that nonpoint source pollution is the leading cause of water quality problems. The effects of nonpoint source pollutants on specific waters vary and may not always be fully assessed. However, we know that these pollutants have harmful effects on drinking water supplies, recreation, fisheries, and wildlife. We all play a part. Nonpoint source pollution results from a wide variety of human activities on the land. Each of us can contribute to the problem without even realizing it

**What can we do about nonpoint source pollution?** We can all work together to reduce and prevent nonpoint source pollution. Some activities are federal responsibilities, such as ensuring that federal lands are properly managed to reduce soil erosion. Some are state responsibilities, for example, developing legislation to govern mining and logging, and to protect groundwater. Others are best handled locally, such as by zoning or erosion control ordinances. And each individual can play an important role by practicing conservation and by changing certain everyday habits.

**9. Reflections and thoughts about personal, community and international actions:**



**You Tube Videos** Search key words: Point Source and Non-point Source Pollution

<b>Non-Point Source Pollution: An introduction to Stormwater</b>	
URL	<a href="http://www.youtube.com/watch?v=cACFw8IzkPI&amp;NR=1">http://www.youtube.com/watch?v=cACFw8IzkPI&amp;NR=1</a>
Producer	<b>UConnNEMO</b>   May 30, 2008 University of Connecticut
Posted Description	A video produced as part of a multimedia website and CD_ROM highlighting the results of the Jordan Cove Urban Watershed Project in Waterford, CT. This project was funded in part by the CT DEP. Use of this video is for educational purposes only.
Length	5:04
# Views	<b>2254</b>
Selection Comments	Non-Point source pollution. The video is professionally produced and narrated. Watershed and drainage systems are highlighted with maps showing how NPSP (nitrogen, excessive nutrients, oils, salts, heavy metals, impervious surfaces can impact a large drainage area.
<b>Water Pollution Final</b>	
URL	<a href="http://www.youtube.com/watch?v=a-x0AJQ5zHQ&amp;NR=1">http://www.youtube.com/watch?v=a-x0AJQ5zHQ&amp;NR=1</a>
Producer	<b>khollis</b>   April 30, 2007
Posted Description	Marty Gottlieb-Hollis & Dan Silverman APES final Student Project
Length	5:03
# Views	<b>123,510</b>
Selection Comments	Point and Non point source pollution examples: The video uses a musical sound track (A Beautiful Day) and still photos with some written text including the Clean Water Act and suggestions for taking personal action.

<b>Stop Non-Point Source Pollution!</b>	
URL	<a href="http://www.youtube.com/watch?v=XdtQhTV0J6g">http://www.youtube.com/watch?v=XdtQhTV0J6g</a>
Producer	<b>benwitherell</b>   April 22, 2009
Posted Description	EPA Water Quality Video Contest entry Student Project
Length	2:55
# Views	<b>775</b>
Selection Comments	This viedo has an informative spoken sound tract and discusses many ways to minimize NPSP. One community project is highlighted for stream bank restoration using a team of volunteers installing erosion control mats.

**You Tube Videos** Search key words: Point Non-Point Source Pollution**TOXIC SPILL TRAIL BC CANADA**

URL	<a href="http://www.youtube.com/watch?v=2zMT6Bt14NA">http://www.youtube.com/watch?v=2zMT6Bt14NA</a>
Producers	TMTV Nelson BC Canada
Description	A Toxic spill into the Columbia River from Teck Cominco - From the TMTV Vault copyright May 2008
Length	2:20
# Views	704
Selection Comments	Point Source example that has a long term and current impact on the columbia River and lake Roosevelt. Mentions the legal rulling for the US to bring action against Canadian companies that break US environmental laws.

**Froglie - Nonpoint Source Pollution Education**

URL	<a href="http://www.youtube.com/watch?v=HhIPtNX5XTM">http://www.youtube.com/watch?v=HhIPtNX5XTM</a>
Producer	Water Environment Federation copyright 2002
Description	Join Finneas Frog & Kris Kroak (puppets) as they show us how to prevent nonpoint source pollution in our daily lives. The video is good information for kids and adults. ( <a href="#">runoff</a> , <a href="#">nonpoint</a> , <a href="#">stormwater</a> , <a href="#">water environment federation</a> )
Length	8minutes 20 seconds
# Views	1,186
Selection Comments	Frog Puppets do a new broadcast discussing frogs as bio-indicators of environmental health, runoff and the various pproducts that can enter the water thru the stormdrain (oil, pesticides, chemicals, fertilizers etc,) Alternatives are suggested such as ladybugs& composting.

**Agroforestry Practices - Riparian Forest Buffers**

URL	<a href="http://www.youtube.com/watch?v=8HDnyV1ViHw">http://www.youtube.com/watch?v=8HDnyV1ViHw</a>
Producer	<a href="#">PublicResourceOrg</a>   July 31, 2010
Posted Description	Agroforestry Practices - Riparian Forest Buffers - Center for Agroforestry 2004 - DVD AF1008 - University of Missouri Center for Agroforestry. Noncommercial use only, video used with permission. Riparian forest buffers are natural or re-established streamside forests made up of tree, shrub and grass plantings. They buffer non-point source pollution of waterways from adjacent land, reduce streambank erosion, protect aquatic environments and enhance wildlife. Learn the basics of establishing a riparian buffer practice and how profitable products, like decorative woody florals, can be implemented into the buffer.
Length	17.02
# Views	41
Selection Comments	The format is of interviews with a farmer who converted some of his property back to the riparian buffer. Non-Point source with suggested Best Management Practices.

**Point Non- Point Enviroscape** (model of watershed and lake or river)

What type of land uses do we see in our watershed? Watersheds are an area of land that all drain to one point. Topography changes from high to low

At each land use identify types of non-point pollution

- Construction site = land erosion
- Neighborhood = pesticides, fertilizers, leaves, grass clippings
- Factory = discuss point vs. non-point source pollution = squirt point source pollution through top of factory and allow to come out pipe in creek
- Farm = animal waste, erosion, fertilizers, pesticides
- Stream Bank= erosion
- Highway = liter and used oil

Let it rain! Let students squirt the rain on the watershed model

**Materials for NPSP simulation:**

Cinnamon = soil erosion

Yellow crystals = pesticides

Green crystals = fertilizers

Brown sprinkles = animal waste

Parsley/oregano = leaves & grass clippings

Soy sauce = used oil

Cocoa & water in small bottle = point source pollution from factory

Spray bottle for rain simulation

**Topics for Discussion**

- the condition of the storm water as it moves through the watershed (water picks up anything in its path)
- the condition of the lake after it rains; discuss the habitat (would fish be able to live in a dirty lake? Aesthetics?)
- water supply and costs associated with clean-up and use
- recreation at the lakes and the effects of pollution on recreation
- ways to avoid non-point source pollution (erosion control, soil testing, re-vegetation, good housekeeping, auto care, litter clean-up)

## Point Sources - Where is the pollution in our county coming from?

County	% Rank in USA	Toxic Chemicals Released by Factories, Power Plants and Other Industrial Companies	What are the Major Pollutants?	Lead Hazards	Superfund Sites
	among ___% of the dirtiest counties	Rank Facility City Pounds	Rank Chemical Name Pounds	___ % of homes have a high lead risk	___% of all counties in USA (#) ___ SFS Name & wastes

County	Clean Air % Rank in USA	How Clean is Your Air? Air Quality (AQ)	Smog and Soot: How Much Air Pollution is Released in Your Community by PS?	Air Pollutant Standards Index										
	among the dirtier ___% of all counties in the U.S. in terms of pm-10 24-hr. ave concentration		Rank Facility Tons	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 15%;">0 - 50</td><td>Good</td></tr> <tr><td>50 - 100</td><td>Moderate</td></tr> <tr><td>100 - 200</td><td>Unhealthful</td></tr> <tr><td>200 - 300</td><td>Very Unhealthful</td></tr> <tr><td>300 - 500</td><td>Hazardous</td></tr> </table>	0 - 50	Good	50 - 100	Moderate	100 - 200	Unhealthful	200 - 300	Very Unhealthful	300 - 500	Hazardous
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County	Clean Water % Rank in USA	impaired water bodies %	Watersheds located in the County	Surface Water - % Rivers, Streams, & Creeks affected by Pollutants	Lakes, Reservoirs, and Ponds % affected by																				
	___% cleanest Surface water	___% impaired	___ County contains a portion of (#) ___ watersheds: (Write the names of watersheds)	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 80%;">Pathogens</td><td>___%</td></tr> <tr><td>Temperature</td><td>___%</td></tr> <tr><td>pH</td><td>___%</td></tr> <tr><td>DO/Organic Enrichment</td><td>___%</td></tr> <tr><td>Metals</td><td>___%</td></tr> </table>	Pathogens	___%	Temperature	___%	pH	___%	DO/Organic Enrichment	___%	Metals	___%	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 80%;">Impaired Biological Community</td><td>___%</td></tr> <tr><td>Other</td><td>___%</td></tr> <tr><td>Temperature</td><td>___%</td></tr> <tr><td>Pathogens</td><td>___%</td></tr> <tr><td>Low DO/Organic Enrichment</td><td>___%</td></tr> </table>	Impaired Biological Community	___%	Other	___%	Temperature	___%	Pathogens	___%	Low DO/Organic Enrichment	___%
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**Teacher Key for [www.scorecard.org](http://www.scorecard.org) Stevens, Lincoln & Ferry Counties**

County	% Rank in USA	Toxic Chemicals Released by Factories, Power Plants and Other Industrial Companies Who Is Polluting? Point Sources				What are the Major Pollutants?			Lead Hazards	Superfund Sites
Stevens	2002 among 40% of the dirtiest counties	<b>Rank</b>	<b>Facility</b>	<b>City</b>	<b>Pounds</b>	<b>Rank</b>	<b>Chemical Name</b>	<b>Pounds</b>	3% of homes have a high lead risk	2004 Best 10% of all counties in USA 1 SFS - Midnight Uranium + Mine ALUMINUM, ARSENIC, BARIUM, BERYLLIUM, CADMIUM, COBALT, COPPER, LEAD, MANGANESE, NICKEL, RADIUM, SELENIUM, THALLIUM, THORIUM, URANIUM, VANADIUM, ZINC,
		1	BOISE KETTLE FALLS PLYWOOD MILL	KETTLE FALLS	29,657	1	METHANOL	29,493		
		2	KETTLE FALLS LUMBER	KETTLE FALLS	83	2	LEAD	247		
		3	STIMSON LUMBER CO. ARDEN OPERATION	COLVILLE	10	3	LEAD COMPOUNDS	10		
Lincoln	Not reported	No Reported Industrial Plants				Ranked in the worst 20% of counties having the highest lead hazard in the USA			5%	None
Ferry	2002, among the dirtier 40% in terms of land releases	<b>Rank</b>	<b>Facility</b>	<b>City</b>	<b>Pounds</b>	<b>Rank</b>	<b>Chemical Name</b>	<b>Pounds</b>	2 % of homes have a high lead risk	2004, this county ranked among the cleanest/best 10% of all counties in the U.S. in terms of the number of designated Superfund sites = 0
		1	KETTLE RIVER OPS. MILL	REPUBLIC	91,511	1	NITRATE	48,005		
		2	ECHO BAY INC. K2 MINE	CURLEW	1,580	2	COPPER	39,002		
						3	CYANIDE	4,500		
						4	LEAD	1,491		
						5	MERCURY S	90		
						6	NITRIC ACID	4		

**Teacher Key for [www.scorecard.org](http://www.scorecard.org) Stevens, Lincoln & Ferry Counties**

County	Clean Air % Rank in USA	How Clean is Your Air? Air Quality (AQ)	Smog and Soot: How Much Air Pollution is Released in Your Community by Point Sources	Air Pollutant Standards Index																															
Stevens	2003 among the dirtier 30% of all counties in the U.S. in terms of pm-10 24-hr. ave concentration	<table border="0"> <tr> <td>% days good AQ:</td> <td>78</td> </tr> <tr> <td>% days moderate AQ</td> <td>22</td> </tr> <tr> <td>% days unhealthful AQ</td> <td>0</td> </tr> <tr> <td>Max PSI level 2003</td> <td>105</td> </tr> <tr> <td>Median PSI level 2003</td> <td>28</td> </tr> <tr> <td>90th % PSI level 2003</td> <td>59</td> </tr> </table>	% days good AQ:	78	% days moderate AQ	22	% days unhealthful AQ	0	Max PSI level 2003	105	Median PSI level 2003	28	90th % PSI level 2003	59	<table border="0"> <tr> <td><b>Rank</b></td> <td><b>Facility</b></td> <td><b>Tons</b></td> </tr> <tr> <td>1.</td> <td>KETTLE FALLS (Electricity)</td> <td>74</td> </tr> <tr> <td>2.</td> <td>NORTHWEST ALLOYS INC</td> <td>19</td> </tr> </table>	<b>Rank</b>	<b>Facility</b>	<b>Tons</b>	1.	KETTLE FALLS (Electricity)	74	2.	NORTHWEST ALLOYS INC	19	<table border="0"> <tr> <td>0 - 50</td> <td>Good</td> </tr> <tr> <td>50 - 100</td> <td>Moderate</td> </tr> <tr> <td>100 - 200</td> <td>Unhealthful</td> </tr> <tr> <td>200 - 300</td> <td>Very Unhealthful</td> </tr> <tr> <td>300 - 500</td> <td>Hazardous</td> </tr> </table>	0 - 50	Good	50 - 100	Moderate	100 - 200	Unhealthful	200 - 300	Very Unhealthful	300 - 500	Hazardous
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Median PSI level 2003	28																																		
90th % PSI level 2003	59																																		
<b>Rank</b>	<b>Facility</b>	<b>Tons</b>																																	
1.	KETTLE FALLS (Electricity)	74																																	
2.	NORTHWEST ALLOYS INC	19																																	
0 - 50	Good																																		
50 - 100	Moderate																																		
100 - 200	Unhealthful																																		
200 - 300	Very Unhealthful																																		
300 - 500	Hazardous																																		
Lincoln	1999 among the dirtiest 20% of all counties in the U.S. in terms of pm-10 emissions.	Lincoln county is ranked among the cleaner 30% of all counties in the US in terms of an average individual's added cancer risk from hazardous air pollutants	How can Lincoln county be in the dirtiest 20% air quality (soot & smog) of all counties but have no industries located in the county?																																
Ferry	1999 ranked average (50%) in carbon monoxide emissions	Ferry county is ranked among the cleaner 30% of all counties in the US in terms of non cancer hazards from hazardous air pollutants	No identified point sources. No air monitoring stations																																

**Teacher Key for [www.scorecard.org](http://www.scorecard.org) Stevens, Lincoln & Ferry Counties**

County	Clean Water % Rank in USA	impaired water bodies %	Watershed located in the County	Surface Water - % Rivers, Streams, & Creeks affected by Pollutants	Lakes, Reservoirs, and Ponds % affected by
Stevens	10 % cleanest Surface water	80% impaired	STEVENS County contains a portion of 6 watersheds: Colville, Franklin D. Roosevelt Lake Kettle, Little Spokane, Lower Spokane, Pend Oreille	Pathogens 51% Temperature 30% pH 24% DO/Organic Enrichment 20% Metals 6%	Impaired Biological Community 62% Other 15% Temperature 8% Pathogens 8% Low DO/Organic Enrichment 8%
Lincoln	20 % cleanest surface water	80 % impaired	LINCOLN County contains a portion of 4 watersheds: Franklin D. Roosevelt Lake, Lower Spokane, Palouse, Upper Crab	Pathogens 55% Temperature 42% DO/Organic Enrichment 28% pH 20% Nutrients 15%	Impaired Biological Community 57% Other 14% Pathogens 14% Ammonia 7% Mercury 7%
Ferry	Top 5% cleanest surface water	60 % impaired	FERRY County contains a portion of 3 watersheds: Franklin D. Roosevelt Lake, Kettle, Sanpoil	Pathogens 52% Temperature 28% pH 16% Low DO/Organic Enrichment 12% Metals 4%	Impaired Biological Community 73% Other 18% Mercury 9% Low DO/Organic Enrichment 9% Temperature 9%

**NOTE:** [Possible inconsistencies](#) between data on (a) impaired waterbodies and (b) percentage of waterbodies assessed

County	% Rank in USA	Toxic Chemicals Released by Factories, Power Plants and Other Industrial Companies Who Is Polluting? Point Sources	What are the Major Pollutants?	Lead Hazards	Superfund Sites
	among ___% of the dirtiest counties	Rank Facility City Pounds	Rank Chemical Name Pounds	___ % of homes have a high lead risk	_____% of all counties in USA (#) _____SFS Name & wastes

County	Clean Air % Rank in USA	How Clean is Your Air? Air Quality (AQ)	Smog and Soot: How Much Air Pollution is Released in Your Community by Point Sources	Air Pollutant Standards Index
	among the dirtier ___% of all counties in the U.S. in terms of pm-10 24-hr. ave concentration		Rank Facility Tons	0 - 50 Good 50 - 100 Moderate 100 - 200 Unhealthful 200 - 300 Very Unhealthful 300 - 500 Hazardous

County	Clean Water % Rank in USA	impaired water bodies %	Watershed located in the County	Surface Water - % Rivers, Streams, & Creeks affected by Pollutants	Lakes, Reservoirs, and Ponds % affected by
	_____% cleanest Surface water	_____% impaired	_____%County contains a portion of (#)_____watersheds: (Write the names of watersheds)	Pathogens _____% Temperature _____% pH _____% DO/Organic Enrichment _____% Metals _____%	Impaired Biological Community _____% Other _____% Temperature _____% Pathogens _____% Low DO/Organic Enrichment _____%

**Stevens County:**

- [1999 Emissions Summary of Criteria Air Pollutants](#)

(Expressed in tons of pollutant emitted)

	<u>Carbon monoxide</u>	<u>Nitrogen oxides</u>	<u>PM-2.5</u>	<u>PM-10</u>	<u>Sulfur dioxide</u>	<u>Volatile organic compounds</u>
<a href="#">Mobile Sources</a>	13,812	2,157	494	1,862	200	2,937
<a href="#">Area Sources</a>	12,392	436	1,498	2,313	40	1,854
<a href="#">Point Sources</a>	3,611	645	88	93	1,538	371
All sources	29,816	3,238	2,079	4,268	1,778	5,162

**Lincoln County Air**


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- [1999 Emissions Summary of Criteria Air Pollutants](#)

(Expressed in tons of pollutant emitted)

	<u>Carbon monoxide</u>	<u>Nitrogen oxides</u>	<u>PM-2.5</u>	<u>PM-10</u>	<u>Sulfur dioxide</u>	<u>Volatile organic compounds</u>
<a href="#">Mobile Sources</a>	6,887	2,747	222	721	277	773
<a href="#">Area Sources</a>	2,822	71	2,189	9,516	11	1,109
All sources	9,709	2,817	2,411	10,237	287	1,882

**Ferry County**


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- [1999 Emissions Summary of Criteria Air Pollutants](#)

(Expressed in tons of pollutant emitted)

	<u>Carbon monoxide</u>	<u>Nitrogen oxides</u>	<u>PM-2.5</u>	<u>PM-10</u>	<u>Sulfur dioxide</u>	<u>Volatile organic compounds</u>
<a href="#">Mobile Sources</a>	3,990	562	134	458	57	1,001
<a href="#">Area Sources</a>	9,450	445	978	1,414	28	720
All sources	13,439	1,006	1,112	1,872	85	1,721

Students set up stream tables with earth material and run water through the system. They observe the processes of erosion and deposition and become familiar with the landforms created.

- Water is an important agent in shaping landforms.
- The wearing away of earth is erosion; the settling of eroded material is deposition.
- Landforms that result from running water include canyons, deltas, and alluvial fans.

- Observe and measure the effects of flowing water in the stream table.
- Compare the features created in the stream tables.
- Communicate the results of the investigations.
- Relate the processes in the stream table to the processes of erosion and deposition.

## GO WITH THE FLOW



Students continue their stream-table investigations, studying variables that affect erosion and deposition—slope of the land and the rate of flow. They design further investigations, recording events and mapping the results.

- The slope of the land over which a river flows affects the processes of erosion and deposition.
- During flooding, the rate of erosion and deposition increases.
- Humans affect the processes of erosion and deposition.

- Observe and measure the results of stream-table investigations.
- Experiment to find the effect of slope and floods on erosion and deposition.
- Communicate the results of experiments in a conference.
- Relate the stream-table results to natural processes